

Claims

1. A semi-solid metal solid phase percentage management method, characterized in that it comprises: a step of preparing a map  
5 expressing a correlation between solid phase percentage and viscosity of a slurry-form semi-solid metal for a given metal composition; a step of setting a target viscosity corresponding to a target solid phase percentage using this map; a viscosity measuring step of measuring the viscosity of a semi-solid metal  
10 in a vessel while cooling it; and a step of carrying out cooling until this viscosity reaches the target viscosity, and by these steps being carried out in from the preparation of the map expressing the correlation between solid phase percentage and viscosity of the semi-solid metal to the end of cooling of the  
15 semi-solid metal, the solid phase percentage of the semi-solid metal is made to match the target solid phase percentage.

2. An apparatus for measuring the viscosity of a semi-solid metal, characterized in that it comprises: stirring means for stirring  
20 a slurry-form semi-solid metal in a vessel; a probe in the form of a cantilever beam having a lower part inserted in the semi-solid metal; probe moving means for moving this probe in a horizontal direction; a load cell for measuring a force that this probe receives from the semi-solid metal; and converting means for  
25 converting from a force detected with this load cell to a viscosity of the semi-solid metal.

3. In a metal molding production line which is a metal molding production line made up of: a vessel capable of receiving a predetermined amount of melt; a semi-solid metal production apparatus for making a slurry-form semi-solid metal by cooling  
5 and stirring a melt in the vessel; a molding machine for molding a metal molded product with the semi-solid metal as a starting material; a carrying apparatus for carrying the vessel from the semi-solid metal production apparatus to the molding machine and feeding the semi-solid metal in the vessel into the molding  
10 machine; and a vessel restoring apparatus for carrying out a predetermined restoring treatment on the vessel emptied by the feeding of the semi-solid metal into the molding machine, the vessel restoring apparatus having air blowing means for removing adhered metal inside the vessel while cooling the vessel by blowing  
15 air into the vessel and coating means for applying a releasing agent to the inside of the vessel,

a metal molded product production line characterized in that the vessel restoring apparatus further has scraping means for scraping off semi-solid metal adhered to the inside of the vessel  
20 before the treatment with the air blowing means.

4. A metal molded product production line according to claim 3, characterized in that the scraping means is provided as a scraper installed in a fixed position, the carrying apparatus is provided  
25 as a multiple joint robot, and the movement of the robot is controlled so that while gripped by the robot the vessel emptied by the feeding of the semi-solid metal into the molding machine

is moved relative to the scraper to scrape off semi-solid metal adhered to the inside of the vessel.

5. In a restoring apparatus which is a restoring apparatus of  
stirring means for carrying out after the production of a semi-  
solid metal a predetermined restoring treatment on stirring means  
of a semi-solid metal production apparatus for making a slurry-form  
semi-solid metal by cooling and stirring a melt with stirring means  
having a cooling metal and a probe for viscosity measurement to  
10 be immersed in a melt contained in a vessel and is made up of cooling  
means for cooling the cooling metal and the probe of the stirring  
means by dipping them in water and coating means for applying a  
releasing agent to the cooling metal and the probe,

a stirring means restoring apparatus of a semi-solid metal  
15 production apparatus characterized in that the restoring  
apparatus further comprises scraping means for scraping off  
semi-solid metal adhered to the probe before the treatment with  
the cooling means, and

the cooling means has a space compartment which water does  
20 not enter for receiving the probe, and has a first dipping part  
for dipping the cooling metal only and a second dipping part for  
dipping at least the probe.

6. In a stirring means restoring method which is a restoring  
method of stirring means carried out after the production of a  
semi-solid metal on stirring means of a semi-solid metal production  
apparatus for making a slurry-form semi-solid metal by cooling

and stirring a melt with stirring means having a cooling metal and a probe for viscosity measurement to be immersed in a melt contained in a vessel and is made up of a cooling step of cooling the cooling metal and the probe of the stirring means by dipping 5 them in water and a coating step of applying a releasing agent to the cooling metal and the probe after the cooling step,

a stirring means restoring method of a semi-solid metal production apparatus characterized in that it includes a scraping step of scraping off semi-solid metal adhered to the probe before 10 the cooling step, and

the cooling step is made up of a first dipping step of dipping only the cooling metal in water and a second dipping step of dipping at least the probe in water, and the treatment time of the second dipping step is set shorter than the treatment time of the first 15 dipping step.

7. In a semi-solid metal injection-molding method wherein repeatedly a vessel emptied by having a slurry-form semi-solid metal poured from it into a molding machine is cooled for a 20 predetermined time in preparation for a next pouring and then semi-solid metal is supplied from a melt holding furnace to this cooled vessel,

a semi-solid metal injection-molding method characterized in that the predetermined time of when the empty vessel is cooled 25 in preparation for the next pouring is determined on the basis of the temperature of the melt holding furnace and the temperature of the empty vessel.

8. In a die casting method for obtaining a cast molding by injecting a slurry-form semi-solid metal with an injecting piston through a gate and forcing the semi-solid metal through a runner and a weir into a cavity having a sand core provided inside it,
- 5        a cast molding die casting method characterized in that before the leading part of the semi-solid metal is forced into the cavity the injecting piston is slowed down and the flow speed of the semi-solid metal is lowered.
- 10 9. A die casting method according to claim 8, characterized in that the injecting piston is slowed down at a position 90 to 97% of the way from the injection start position of the injecting piston to the position of the injecting piston when the semi-solid metal first starts to enter the cavity.
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10. A die casting method according to claim 8, characterized in that the cast molding is a cylinder block of an engine and a cooling water jacket is formed by the sand core being removed after the casting.
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